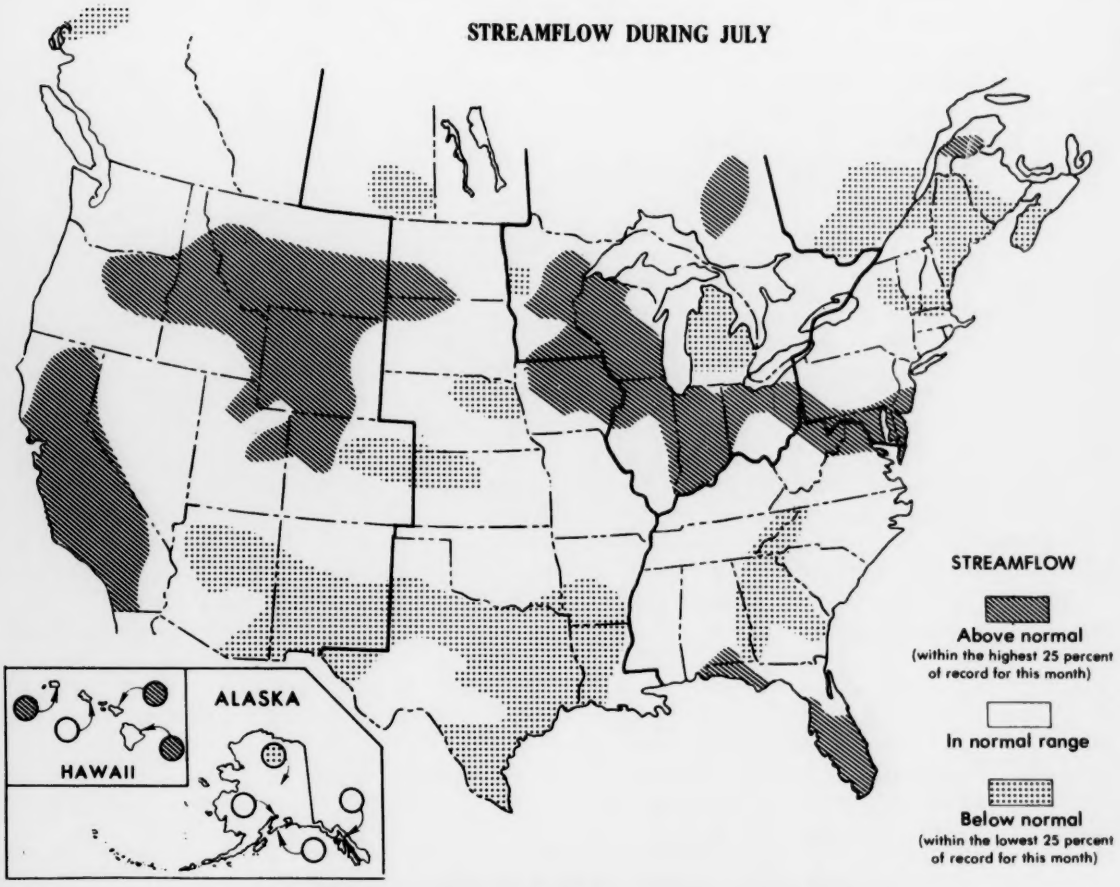
WATER RESOURCES REVIEW for JULY 1978

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH



STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow generally increased in Hawaii, Illinois, Indiana, Iowa, Kentucky, West Virginia, and Wisconsin; was variable in Alaska, Florida, Minnesota, and South Dakota; and generally decreased seasonally elsewhere.

Record-breaking flood events occurred in parts of Alabama, Minnesota, and Wisconsin. Flooding was also reported in parts of Indiana, Iowa, Maryland, Nebraska, and North Carolina.

Above-normal streamflow persisted in parts of Ontario, Hawaii, Florida, and in many western States, and increased into that range in several north-central and eastern States.

Flows remained below the normal range in parts of British Columbia, Saskatchewan, Nova Scotia, Alaska, Colorado, Louisiana, Michigan, Minnesota, and Texas. Drought conditions continued to spread in eastern Texas and many streams were dry at monthend in western Kansas and southwestern Nebraska. Monthly and/or daily mean discharges were lowest of record for July in parts of Alaska and Arizona.

Ground-water levels continued to decline seasonally, and were near or above average, in most of the Northeast. Levels generally declined in the Southeast, with mixed trends in Florida and West Virginia; levels were above average in much of the northern part of the region, but commonly below average in the southern States. Trends were mixed, and levels were above and below average, in the Western Great Lakes region. Declining levels prevailed for the most part in the Midcontinent and in the West; levels were above average in Iowa and Nebraska, but were generally below average or mixed in other States in both regions.

A new July high level occurred in Arizona. New lows for July were recorded in Arizona, Arkansas, Idaho, Louisiana, Mississippi, New Mexico, Tennessee, and Washington. New alltime lows were reached in Georgia, Idaho, Kansas, and Texas.

NORTHEAST

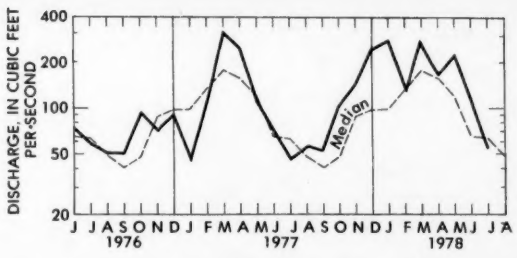
[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow decreased seasonally at all index stations in the region except two. Monthly mean flows remained in the above-normal range in parts of New Jersey and Maryland, and increased into that range in parts of Quebec and Pennsylvania. Flows remained in the below-normal range in part of Nova Scotia and decreased into that range in Maine and in parts of New Brunswick, Quebec, and New York.

Ground-water levels continued to decline seasonally, and were near or above average in most of the region.

In central Maryland, monthly mean discharge at Seneca Creek at Dawsonville continued to decrease seasonally but remained in the above-normal range for the 3d consecutive month at over twice the median flow. In the Choptank River basin in eastern Maryland, where streamflow during June was in the normal range and 177 percent of median, the seasonal decrease in flow was only 5 percent compared to a normal decrease of 31 percent and the resulting monthly mean discharge was above the normal range. Heavy rains at the beginning of the month caused some local flooding in the western part of the State.

In southern New Jersey, monthly mean flow at the index station, Great Egg Harbor River at Folsom, increased, contrary to the normal seasonal pattern of decreasing flow, and remained in the above-normal range for the 3d consecutive month. In the northern part of the State and typical of the streamflow trend in much of the central part of the region, monthly mean flow at South Branch Raritan River near High Bridge decreased seasonally to the normal range and was 88 percent of median. (See graph.) Cumulative runoff at that station



Monthly mean discharge of South Branch Raritan River near High Bridge, N.J. (Drainage area, 65.3 sq mi; 169 sq km)

for the first 10 months of the 1978 water year was 148 percent of median.

In the Monongahela River basin, in southwestern Pennsylvania and the adjacent area of West Virginia, monthly mean discharge at the index station at Braddock, Pa., increased sharply, contrary to the normal seasonal pattern of decreasing flows, and was in the above-normal range. Elsewhere in Pennsylvania, monthly mean flows decreased seasonally at the remaining index stations, were in the normal range, and were near or slightly above median.

In northeastern New York, flow in Hudson River at Hadley decreased sharply to ½ the monthly median discharge and was below the normal range for the first month since July 1977. Elsewhere in the State, mean flows at the index stations decreased seasonally, were generally less than median, but within the normal range.

In central New England, streamflow generally declined seasonally at all index stations and monthly runoff ranged from 75 percent of median to 119 percent but all flows were within the normal range at their respective sites.

In southern Maine, monthly mean discharge in Little Androscoggin River near South Paris decreased sharply to only 39 percent of median and was below the normal range for the first time since May 1977. Similarly, in the

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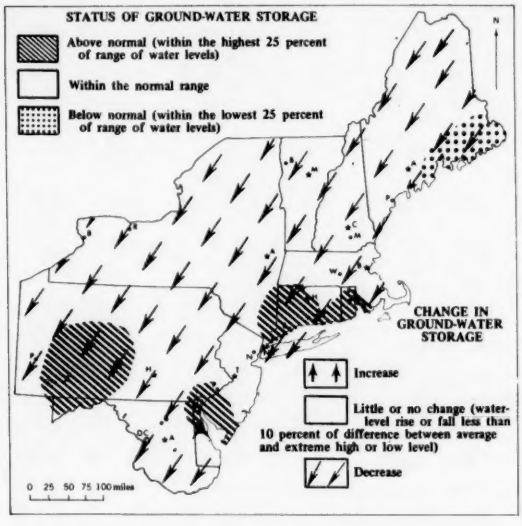
central part of the State, mean flow in Piscataquis River near Dover-Foxcroft decreased seasonally, was only 29 percent of median, and was also below the normal range for the first time since May 1977. In the northern part of the State, flow in St. John River below Fish River, at Fort Kent, decreased to 76 percent of the July median and was below the normal range after 17 consecutive months of monthly mean flows that were in the normal range or above.

In southern New Brunswick, monthly mean flow in Lepreau River at Lepreau decreased seasonally and was below the normal range. In southern Nova Scotia, mean flow in LaHave River at West Northfield remained in the below-normal range for the 2d consecutive month at about 50 percent of median. Elsewhere in the Atlantic Provinces, streamflow was less than median but generally within the normal range.

North of the St. Lawrence River in southern Quebec, monthly mean discharges in St. Maurice River at Grand Mere and Coulonge River near Fort-Coulonge remained below median for the 2d consecutive month and were below the normal range during July. In southeastern Quebec, where streamflow during June in Matane River at Matane was in the normal range, the seasonal decrease in flow was 30 percent compared to a normal decrease of 60 percent and the resulting monthly mean discharge was above the normal range. Elsewhere in the Province, streamflow also decreased seasonally but was generally within the normal range.

Ground-water levels continued to decline seasonally in most of the region, and were near average in most areas. Above-average levels persisted in much of Connecticut, west-central Pennsylvania, and a few smaller areas. (See map.)



Map shows ground-water storage near end of July and change in ground-water storage from end of June to end of July.

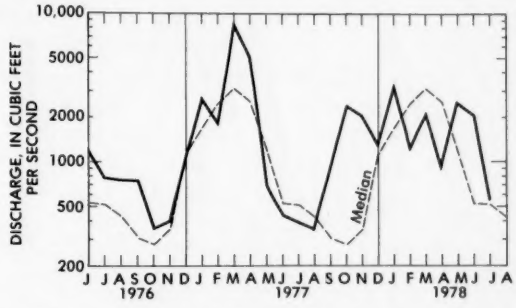
SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow increased in Kentucky, decreased in Alabama, Georgia, Mississippi, Tennessee, and Virginia, and was variable in North Carolina, South Carolina, and West Virginia. Monthly mean flows remained in the above-normal range in parts of Florida, and increased into that range in parts of West Virginia. Flows decreased into the below-normal range in parts of Florida, Georgia, North Carolina, and Tennessee. Daily mean discharge was highest of record for July in part of West Virginia. Flooding occurred in Alabama and North Carolina.

Ground-water levels generally declined in the region except for mixed trends in West Virginia and Florida. Levels were generally above average in Kentucky, Virginia, and North Carolina, mixed in West Virginia, and generally below average in other States. New lows for July were reached in Tennessee and Mississippi, and a new alltime low occurred in Georgia.

In extreme southern Alabama, severe flooding occurred July 26 in and near Fairhope, a few miles southeast of Mobile on the eastern shore of Mobile Bay. National Weather Service reported 15.46 inches of rain at Fairhope during the first 11 hours of that date, exceeding the record rainfall of 13.36 inches in 24 hours for the period 1891 to date at that site, and also exceeding the 100-year 12-hour rainfall of 12 inches for the Mobile area. Elsewhere in the State, monthly mean flows decreased sharply from the above-normal flows of June, and were in the normal range. For example, in central Alabama, mean flow of Cahaba River at Centreville decreased from 388 percent of median in June to 111 percent in July. (See graph.)



Monthly mean discharge of Cahaba River at Centreville, Ala. (Drainage area, 1,029 sq mi; 2,665 sq km)

In north-central North Carolina, rapid runoff from intense rainfall July 15, 16, resulted in minor flooding

along Reedy Fork in Guilford County. The peak discharge of 2,300 cfs July 16 at the gaging station, Reedy Fork near Oak Ridge (drainage area, 19.9 square miles) was equal to that of a 10-year flood at that site. In the extreme southwestern part of the State, mean flow in French Broad River at Asheville decreased sharply and was below the normal range. Elsewhere, monthly mean discharges were variable and were in the normal range.

In northern Virginia, where median flow in Rapidan River near Culpeper in July is less than in June, mean flow did not decrease and the monthly mean was above the normal range. In central and southern parts of the State, mean flows decreased, were in the normal range, and generally were greater than the July median flows.

In northern West Virginia, monthly mean flow of Potomac River at Paw Paw (drainage area, 3,109 square miles) increased sharply as a result of runoff from rains early in the month, and was above the normal range. The daily mean discharge of 23,100 cfs on July 4 was highest for the month since records began in October 1938. Elsewhere in the State, monthly mean flows decreased in some streams and increased in others, but remained in the normal range.

In Kentucky, mean flows increased, contrary to the normal seasonal pattern of decreasing flow, but remained within the normal range.

In adjacent Tennessee, monthly mean flows decreased seasonally and were in the normal range except in the extreme northeastern part of the State where mean flow of French Broad River below Douglas Dam was in the below-normal range.

In Mississippi, where monthly mean discharges generally were above the normal range in June, mean flows decreased sharply and were in the normal range. In the northeastern part of the State, monthly mean discharge of Tombigbee River at Columbus was only 57 percent of the July median.

In South Carolina, flows increased in some streams and decreased in others, but generally were in the normal range and were somewhat greater than median.

In Georgia, mean flows generally continued to decrease seasonally and were in the below-normal range except in the south-central part of the State, where mean discharge of Alapaha River at Statenville remained in the normal range. In northeastern Georgia, monthly mean discharge at Altamaha River at Doctortown decreased sharply into the below-normal range and was only 57 percent of median.

In the extreme northwestern part of Florida, monthly mean flow of Shoal River near Crestview continued to decrease but remained in the above-normal range for the 7th consecutive month. Cumulative runoff at this station for the first 10 months of the 1978 water year was 203 percent of median. In the west-central part of the State, mean flow in Peace River at Arcadia increased sharply, was twice the July median, and was above the normal range. In the Apalachicola River basin, in northwestern Florida and the adjacent areas of Alabama and Georgia, monthly mean flow at the index station at Chattahoochee, Fla., decreased sharply and was below the normal range. Headwaters of this basin are in northwestern Georgia, where flows also were below the normal range.

Ground-water levels in West Virginia declined in the southeastern half of the State and in the eastern panhandle, and rose elsewhere. Levels were below average in the southern half of the State and above average elsewhere. In Kentucky, levels continued to rise slightly in the Louisville-Jefferson County area, but declined elsewhere. Levels were generally above average throughout the State. In Virginia, levels declined but continued above average in the three key wells. In western Tennessee, the artesian level in the key well in the "500-foot sand" near Memphis declined slightly and was at a new low for July; the level continued more than 15 feet below average. In North Carolina, levels declined but were above average across the entire State. In Mississippi, levels declined, and new lows for July were reached in all of the key wells in the Sparta Sand and the Cockfield Formation in the Jackson metropolitan area. Levels generally declined in Alabama; the level in the well in the Eutaw Formation in Montgomery declined 0.7 foot but continued about 2 feet above average. In Georgia, levels in the Piedmont declined 1 to 3 feet. In the coastal counties, levels held steady in some wells but declined as much as 4 feet in others. The level in the Cockspur Island well in the Savannah area declined about a foot and reached a new alltime low in 22 years of record. In southwestern Georgia, levels declined as much as 2 feet during July but ranged up to 8 feet above those of a year ago. In Florida, levels rose in most of the northern part of the State but were below average; levels declined and were below average in the southeast.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow decreased in Ontario and Michigan, increased in Indiana, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Ontario, Ohio, and Illinois, and increased into that range in parts of Indiana, Minnesota, and Wisconsin. Flows remained below the normal range in parts of Michigan and Minnesota. Flooding occurred in Indiana, Minnesota, and Wisconsin.

Ground-water levels generally declined in the region except in Wisconsin and in northern Minnesota. Levels

were below average in Minnesota, generally below average in Michigan, mostly average in Indiana, and above average in Wisconsin, northern Illinois, and Ohio.

Severe flooding occurred in parts of southeastern Minnesota as a result of rapid runoff from intense thunderstorm rainfall. The peak discharge of 30,500 cfs at the gaging station on South Fork Zumbro River near Rochester on July 6 was the largest observed there since at least 1908 and was greater than that of a 100-year flood. Damage was reported to be especially severe in the city of Rochester, where several thousand residents were evacuated, at least 9 persons were known dead, and many were reported missing. National Weather Service reported that 5.8 inches of rain fell in 5 hours at Rochester, which is in the drainage basin of South Fork Zumbro River. About 35 miles southwest of Rochester, flooding occurred along Cedar River in and near Austin July 6, 7. The peak discharge of 10,200 cfs at the gaging station near Austin on July 7 was the largest observed there in 39 years of record. Ten days later, however, this discharge was exceeded by a flood peak of 12,400 cfs during a second record-breaking flood event in that city. These and other selected data on stages, discharges, recurrence intervals, and gaging station locations are given in the accompanying map and table (on page 6). In

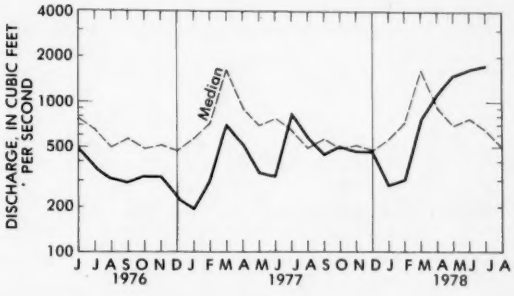
Location of stream-gaging stations in Minnesota and Wisconsin, described in table of peak stages and discharges.

central and north-central parts of the State, mean flows of Crow River at Rockford and Mississippi River at St. Paul, respectively, increased, in contrast to the normal seasonal pattern of decreasing flows, and were in the above-normal range. In western Minnesota, monthly mean flow of Buffalo River near Dilworth continued to decrease seasonally and remained in the below-normal range.

Severe flooding occurred also in Kickapoo River basin in west-central and southwestern parts of Wisconsin early in July. Sixteen counties were reported to have been declared eligible for Federal disaster assistance and total losses were estimated by local officials to be $53 million, including $33 million in damages related to agriculture. National Weather Service reported rainfall of as much as 6 inches in a period of about 20 hours in parts of the basin. Selected data on stages, discharges, recurrence intervals, and gaging station locations are given in the accompanying map and table on page 6. In northeastern Wisconsin, mean flow in Oconto River near Gillett decreased seasonally and remained in the normal range for the 4th consecutive month. Elsewhere in the State, monthly mean flows at the index stations increased, contrary to the normal seasonal pattern of decreasing flows, and were in the above-normal range in the Chippewa, Fox, Jump, and Wisconsin River basins.

In extreme southwestern Indiana, minor local flooding was reported to have occurred in Evansville July 2 as a result of rapid runoff from intense rainfall of as much as 4 inches. Runoff from other thunderstorms July 14 and 24 resulted in increased flows in many streams throughout the State. Monthly mean discharge of East Fork White River at Shoals, Mississinewa River at Marion, and Wabash River at the border city of Mt. Carmel, Ill., increased, in contrast to the normal seasonal pattern of decreasing flows, and were above the normal range.

In Rock River basin in northern Illinois, where median flow of Rock River at Joslin is less in July than in June, monthly mean flow at Joslin increased, contrary to that normal seasonal pattern, and was 4½ times the July median discharge. Also in Rock River basin, mean flow of Pecatonica River at Freeport increased, in contrast to the seasonal pattern, and was nearly 3 times the median flow for the month. (See graph.) In the



Monthly mean discharge of Pecatonica River at Freeport, Ill. (Drainage area, 1,326 sq mi; 3,434 sq km)

central part of the State, monthly mean flow in Sangamon River near Monticello also increased, contrary

(Continued on page 8.)

Provisional data; subject to revision

FLOOD DATA FOR SELECTED SITES IN MINNESOTA AND WISCONSIN, JULY 1978

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Discharge (cfs)	Date	Stage (feet)	Discharge		Recurrence interval (years)
									Cfs	Cfs per square mile	
	MINNESOTA										
	ZUMBRO RIVER BASIN										
05372800	South Fork Zumbro River on Belt Line at Rochester.	155	1969–	Mar. 10, 1973	1,001.78	6,020	July 6	1,005.97	20,500	132	>100
05372930	Bear Creek on Belt Line at Rochester.	80.0	1969–	June 21, 1974	1,003.39	5,800	6	1,007.89	[a]	.....	.....
05372950	Silver Creek at Rochester	17.3	1969–	June 21, 1974	1,015.65	6,580	6	1,016.18	[a]	.....	.....
05373000	South Fork Zumbro River near Rochester.	304	1908–	Mar. 1, 1965	19.12	19,600	6	23.36	30,500	100	>100
05374000	Zumbro River at Zumbro Falls.	1,130	1909–17, 1930–	July 22, 1951	30.80	35,900	7	24.26	20,800	18.4	8
	WHITEWATER RIVER BASIN										
05376500	South Fork Whitewater River near Altura.	76.8	1939–71, 1973–	June 21, 1974	10.84	5,620	5	10.83	5,610	73.0	25
05376800	Whitewater River near Beaver.	271	[b]1938, 1940–56, 1974–	July 21, 1974	13.0	19,200	6	12.75	16,500	60.9	40
	GARVIN BROOK BASIN										
05378300	Straight Valley Creek near Rollingstone.	5.16	1959–	July 26, 1959	17.28	1,200	6	18.24	1,550	300	40
	ROOT RIVER BASIN										
05384000	Root River near Lanesboro.	615	1910–17, 1940–	Mar. 29, 1962	16.11	22,100	7	15.41	15,500	25.2	5
05384500	Rush Creek near Rushford.	129	1942–	Mar. 26, 1950	13.54	11,600	1	10.97	6,960	54.0	5
05385500	South Fork Root River near Houston.	275	1953–	June 21, 1974	13.81	11,000	1	13.79	11,000	40.0	33
	IOWA RIVER BASIN										
05457000	Cedar River near Austin..	425	1909–14, 1944–	Mar. 29, 1962	17.18	9,530	7	18.14	10,200	24.0	20
				Mar. 1, 1965	[c]18.87	9,400	17	20.35	12,400	28.5	25
	WISCONSIN										
	WISCONSIN RIVER BASIN										
05408000	Kickapoo River at LaFarge.	266	1938–	Feb. 9, 1966	13.67	9,910	July 1	14.92	13,500	50.8	>100
.....	Kickapoo River near Viola.	.....	.....	Mar. 28, 1961	.....	3,810	2	66.67	13,700	.....	>100
05410500	Kickapoo River at Steuben.	690	1934–	Mar. 28, 1961	12.33	10,800	3	14.80	17,600	25.5	>100

[a]Discharge not determined.
[b]1938, 1940–56, 1974, at site 0.6 mile downstream, including Beaver Creek.
[c]From floodmark; backwater from ice.

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	July 31, 1978	Monthly mean, July		July		
		1978	1977	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	601.01	600.89	600.57	600.89	601.89 (1950)	598.99 (1926)
Michigan and Huron (Harbor Beach, Mich.)	579.02	578.99	578.57	578.68	581.04 (1974)	575.96 (1964)
St. Clair (St. Clair Shores, Mich.)	574.60	574.67	574.31	573.84	576.20 (1973)	571.88 (1934)
Erie (Cleveland, Ohio)	571.78	571.95	571.70	570.92	573.34 (1973)	568.46 (1934)
Ontario (Oswego, N.Y.)	245.43	245.70	245.09	245.47	247.74 (1947)	242.75 (1934)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	July 31, 1978	July 31, 1977	Reference period 1904–77		
			July average, 1904–77	July maximum (year)	July minimum (year)
Elevation in feet above mean sea level:	4,199.35	4,199.75	4,198.5	4,204.4 (1923)	4,192.15 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827–1977): 102.1 (1869). Alltime low (1939–1977): 92.17 (1941).	July 28, 1978	July 31, 1977	Reference period 1939–75		
			July average, 1939–75	July max. daily (year)	July min. daily (year)
Elevation in feet above mean sea level:	95.58	94.77	95.69	99.34 (1973)	93.81 (1965)

FLORIDA

Site	July 1978		June 1978	July 1977
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	810	107	830	700
Miami Canal at Miami (southeastern Florida)	262	106	284	203
Tamiami Canal outlets, 40-mile bend to Monroe	694	269	250	162

(Continued from page 5.)
to the seasonal pattern, was in the normal range, and was slightly greater than median. In southern Illinois, mean discharge in Skillet Fork at Wayne City continued to decrease seasonally and was only 15 percent of median.

In northwestern Ohio, mean flow in Maumee River at Waterville increased, as a result of runoff from rains early in the month, was in the above-normal range, and was 2½ times the July median. In the east-central part of the State, monthly mean flow of Little Beaver Creek near East Liverpool continued to decrease seasonally but, as a result of increased runoff from rains early in the month, augmented by high carryover flow from June, remained above the normal range for the 3d consecutive month.

In Michigan's Upper Peninsula, monthly mean flow in Sturgeon River near Sidnaw continued to decrease seasonally but remained within the normal range, as a result of runoff from midmonth rains. In the Lower Peninsula, mean discharge in Red Cedar River at East Lansing decreased seasonally, remained below the normal range, and was only 44 percent of median. In the northern part of the Lower Peninsula, mean flow of Muskegon River at Evart decreased seasonally, was in the below-normal range, and remained below median for the 3d consecutive month.

Monthly mean flows at all index stations in Ontario decreased seasonally, but in the eastern part of the Province, mean discharge of Missinaibi River at Mattice remained in the above-normal range and was 225 percent of median. Elsewhere in the Province, mean flows were in the normal range and were either slightly greater or slightly less than median.

Ground-water levels in shallow water-table wells in Minnesota rose in the northern part of the State but were below average, and continued to decline in the south, where they were below average for the first time in 8 months. Artesian levels in the Minneapolis-St. Paul area continued to decline in wells tapping the Prairie du Chien-Jordan aquifer and the deeper Mt. Simon-Hinckley aquifer; levels in both continued below average. Levels in Wisconsin generally rose in response to the abundant rainfall during early July. In Michigan, levels declined statewide and were below average in most areas. In northern Illinois, the level in the shallow index well in glacial drift at Princeton, in Bureau County, declined nearly 1¼ feet and continued above average. In Indiana, levels were generally average at month's end except in the northeastern part of the State, where they continued slightly below average. Levels declined in the key wells in central and northeastern Ohio, but were above average in both areas at month's end.

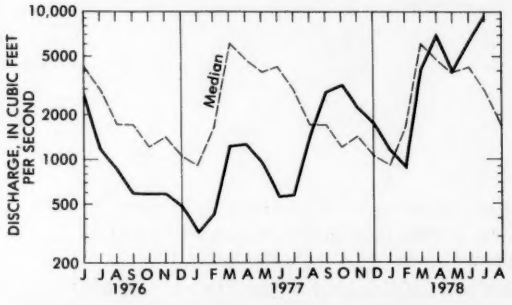
MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow increased in Iowa and in parts of Kansas and South Dakota, contrary to the normal seasonal pattern of decreasing flows, but decreased seasonally elsewhere in the region. Monthly mean flows remained in the below-normal range in parts of Saskatchewan, Kansas, Louisiana, and Texas, and decreased into that range in parts of Arkansas and Nebraska. Drought conditions continued to spread in eastern Texas, and many streams were dry at monthend in western Kansas and southwestern Nebraska. Flows were in the above-normal range in parts of Iowa and North Dakota. Flooding occurred in Iowa and Nebraska.

Ground-water levels generally declined in the region except for slight rises in western North Dakota and in east-central Iowa. Levels were above average in Nebraska, Iowa, and western North Dakota, and locally in Kansas and Texas, but were below average elsewhere. New July lows occurred in Arkansas and Louisiana, and new alltime lows were reached in Kansas and Texas.

Moderate to severe flooding occurred along several streams in eastern Iowa during July. Rapid runoff from intense rainfall on July 2 resulted in severe flooding along Waterloo Creek in and near Dorchester, in Upper Iowa River basin. During the period July 19–21, intense rainfall occurred each day in the Iowa River basin between Grinnell and Marengo. Runoff from these storms resulted in a moderate peak discharge of 13,500 cfs at the gaging station at Marengo. This peak flow is significant because it was generated from only a small part of the drainage area. Also in Iowa River basin, a peak discharge of 5,340 cfs (equal to that of a 15-year flood) occurred at the gaging station, Walnut Creek near Hartwick (drainage area, 70.9 square miles) on July 20, and a peak discharge of 6,400 cfs (equal to that of a 5-year flood) occurred July 21 on Big Bear Creek at Ladora (drainage area, 189 square miles). In Cedar River basin, moderate peak discharges of 9,860 cfs (on July 8), and 10,700 cfs (on July 18) occurred on Cedar River at Charles City. Those peaks resulted from the storms that caused the flooding along Cedar River at Austin, Minn., July 7 and 17. Downstream at Cedar Rapids, monthly mean flow of Cedar River increased into the above-normal range and was 3 times the July median. (See graph.) In the central part of the State, mean flows in



Monthly mean discharge of Cedar River at Cedar Rapids, Iowa (Drainage area, 6,510 sq mi; 16,861 sq km)

Des Moines River at Fort Dodge and Des Moines River below Raccoon River at Des Moines, also increased into the above-normal range, and were 2½ and 2 times the respective July medians. Mean flow also increased unseasonally in Nishnabotna River above Hamburg, in southwestern Iowa, but remained in the normal range.

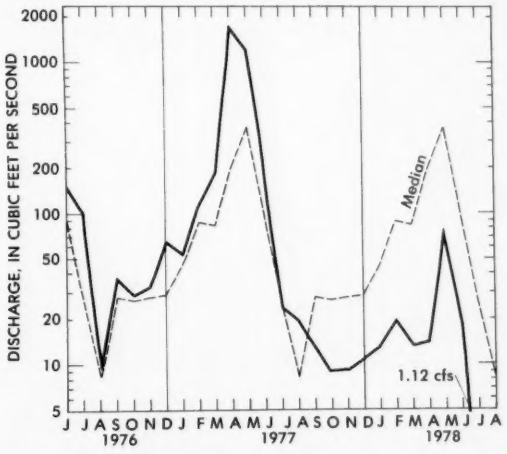
In southeastern Nebraska, rapid runoff from intense rains on July 21 resulted in moderate flooding along Stevens Creek, Weeping Water Creek, Little Nemaha River, and Big Nemaha River. Peak discharges generally were equivalent to those of the 5- to 10-year floods for the respective sites, except on Weeping Water Creek at Union, where the peak discharge was estimated to equal that of a 25-year flood discharge. In the western (panhandle) part of the State, intense rains were reported to have fallen during the period July 19–23, resulting in high flows on many of the tributaries of North Platte River. For example, the peak discharge of 505 cfs, observed on Sheep Creek near Morrill, was the maximum discharge observed at that site in 46 years of record. Flow in Niobrara River above Box Butte Reservoir also increased during this period of rainfall and the monthly mean discharge remained in the normal range, partly as a result of that increased flow. Intense rains also were reported in the Lodgepole Creek basin in the panhandle on July 5 and the runoff from those rains resulted in bankfull stages along Lodgepole Creek near Bushnell. In the northeastern part of the State, mean flow of Elkhorn River at Waterloo decreased sharply and was below the normal range, and in the southwestern part of the State, most streams were reported to be dry at monthend.

In western Kansas, a number of gaging stations also were recording zero flow at monthend. For example, South Fork Solomon River above Webster Reservoir was reported to have been dry for the past 3 months. In the adjacent basin of Saline River, mean flow near Russell decreased into the below-normal range and was only 11 percent of median. In southwestern Kansas, mean flow in Arkansas River at Arkansas City decreased seasonally but remained in the normal range. In northeastern Kansas, mean flow of Little Blue River near Barnes increased sharply, as a result of runoff from the rains in the headwaters area in Nebraska July 21.

In Missouri, Oklahoma, northern Arkansas, and southern Louisiana, monthly mean flows decreased seasonally but remained in the normal range. In southern Arkansas, mean flow in Saline River near Rye decreased sharply, was only ½ the July median flow, and was below the normal range for the 3d time in the past 5 months.

In the adjacent area of northern Louisiana, mean flow in Saline Bayou near Lucky also decreased sharply, was only 1/3 the July median, and was below the normal range for the 4th time in the past 5 months. Cumulative runoff at this index station for the first 10 months of 1978 water year was only ½ the median runoff for that period. In west-central Louisiana, monthly mean discharge in Calcasieu River near Oberlin also decreased sharply and was below the normal range for the 4th time in the past 5 months.

In the adjacent area of eastern Texas, mean flow of North Bosque River near Clifton also decreased sharply and was only 4 percent of the July median flow. (See graph.) Similarly, monthly mean flow of Neches River



Monthly mean discharge of North Bosque River near Clifton, Tex. (Drainage area, 972 sq mi; 2,517 sq km)

near Rockland decreased sharply, was 14 percent of median, and remained in the below-normal range for the 5th consecutive month. Elsewhere in the State, flows were reported to be below the normal range except in Rio Grande, Pecos River, and Devils River basins, where they were near normal.

In central South Dakota, mean flow in Bad River near Fort Pierre decreased seasonally but was in the normal range. In Big Sioux River basin, in eastern South Dakota and the adjacent areas of Minnesota and Iowa, mean flow as measured at Akron, Iowa, increased, contrary to the normal seasonal pattern of decreasing flows, but remained in the normal range.

In southwestern North Dakota, mean flow in Cannonball River at Breien decreased seasonally but was above the normal range as a result of high carryover flow from June. In eastern North Dakota, mean flow in Red River of the North at Grand Forks also decreased seasonally but remained in the normal range for the 3d consecutive month.

In southeastern Saskatchewan, monthly mean discharge of Qu'Appelle River near Lumsden continued to

decrease seasonally, remained in the below-normal range for the 3d consecutive month and was only 44 percent of the median flow for July.

In southern Manitoba, monthly mean flow of Waterhen River below Waterhen Lake decreased seasonally, was slightly less than median, and remained within the normal range for the 22d consecutive month. The level of Lake Winnipeg at Gimli averaged 714.42 feet above mean sea level for the month, 0.39 foot higher than last month, 2.66 feet higher than last July, and 0.27 foot higher than the long-term average for July. The record of Lake Winnipeg levels began in May 1913 at Winnipeg Beach.

Ground-water levels in North Dakota rose and were a little above average in the west, but declined and were below average in the east. Levels in Nebraska declined statewide, particularly in areas where there is extensive pumping for irrigation; levels were generally slightly above average. In Iowa, levels in shallow water-table wells declined seasonally in all but the east-central part of the State; levels were above-average statewide. Levels in Kansas declined statewide, owing to lack of significant precipitation during July. An alltime low in 31 years of record was reached in the well at Colby, in Thomas County, in the northwest Kansas high plains. Levels were mostly below average. In the rice-growing area of east-central Arkansas, the water level in the shallow Quaternary aquifer declined slightly and was below average, but was in the same range that has prevailed since 1961. The level in the deep aquifer—the Sparta Sand—declined about 43 feet, and was about 45 feet below average, reaching a new low for July. In the industrial aquifer of central and south Arkansas, the level in the key well at Pine Bluff declined slightly and was about 15½ feet below average——also setting a new July low. In Louisiana, levels in wells in most aquifers in the southeast continued to decline from spring highs. Levels in wells in the heavily pumped "2,000-foot sand" in the Baton Rouge area showed little change during July. Levels in wells in the Chicot aquifer of the southwest generally declined in the rice-irrigation areas and in the Lake Charles industrial area ("500-foot sand"). Levels in the key wells in the Evangeline aquifer in the Opelousas and Eunice areas declined, reaching record lows for July. In the northern and central parts of Louisiana, seasonal declines occurred in wells screened in the Wilcox, Cockfield, terrace, and alluvial aquifers. The level in the key well in the Wilcox aquifer, in northern De Soto Parish, has declined about 3 feet per year since 1973. Other Wilcox wells that monitor regional trends have shown only seasonal fluctuations. Regional water-level declines continued in wells screened in the Sparta and Miocene aquifers. In Texas, levels in key wells in the Edwards Limestone declined but were above average in Austin, and declined and were below average in San Antonio. Levels in wells in the Evangeline aquifer at Houston declined and continued below average; levels in the bolson deposits at El Paso also declined and continued below average. New alltime lows were again reached in the key wells at El Paso and in the Ogallala Formation at Plainview in the Texas Panhandle.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

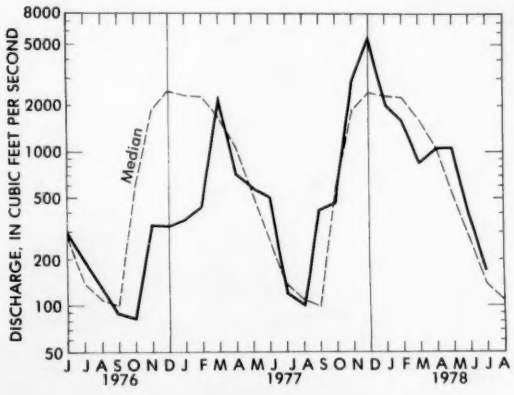
Streamflow generally decreased seasonally in most of the region but increased in parts of Alberta, Arizona, and California. Monthly mean flows remained in the above-normal range in parts of California, Colorado, Idaho, Utah, and Wyoming, and increased into that range in parts of Montana and Oregon. Flows remained in the below-normal range in parts of British Columbia and Colorado, and decreased into that range in parts of Arizona and New Mexico.

Ground-water levels generally declined in the region, although mixed trends were observed in Idaho, Utah, and Arizona. Levels were generally below average except in eastern Washington and locally in Idaho, California, and Nevada. A new high for July was recorded in Arizona; new July lows were reached in Washington, Idaho, Arizona, and New Mexico, and a new alltime low in Idaho.

In southern California, monthly mean flow of Arroyo Seco near Pasadena remained in the above-normal range for the 8th consecutive month and cumulative runoff for the first 10 months of the 1978 water year was over 9 times normal. In the southern part of the Sierra Nevada, runoff was highest from near-record accumulations of snow, principally in the Kings, Kaweah, and Kern River basins. At the index station, Kings River above North Fork, near Trimmer, monthly mean flow remained in the above-normal range for the 3d consecutive month at 420 percent of median. Cumulative runoff at that site thus far in the 1978 water year was 215 percent of median. In the central part of the Sierra Nevada, monthly mean flow of North Fork American River at North Fork Dam decreased seasonally but was above the normal range at 179 percent of median. On the central Sierra Nevada east slope, monthly mean flow of West Walker River below Little Walker River, near Coleville, decreased seasonally but remained in the above-normal range for the 2d consecutive month at 236 percent of the July median flow. Combined monthend storage in

10 of the major reservoirs in northern California was 115 percent of average and more than three times that of a year ago.

In northwestern Oregon, where monthly mean discharge in Wilson River near Tillamook was in the above-normal range during May and June, flow decreased sharply to 124 percent of median and was within the normal range. (See graph.) In the north-central part



Monthly mean discharge of Wilson River near Tillamook, Oreg. (Drainage area, 161 sq mi; 417 sq km)

of the State, monthly mean discharge in John Day River at Service Creek decreased seasonally to less than ½ the June monthly mean discharge but was above the normal range in July. Elsewhere in the State, mean flows at the index stations were near or slightly below median but within the normal range.

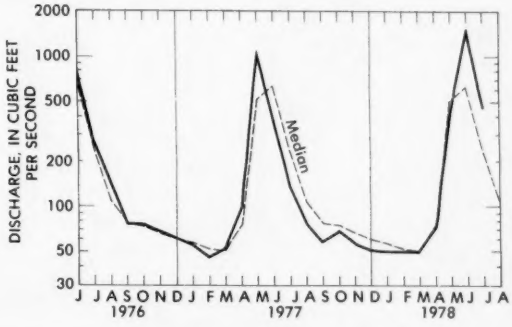
In Washington, streamflow remained in the normal range at all index stations and was generally greater than median except in Skykomish River near Gold Bar, on the northwest slope of the Cascade range, where monthly mean flow was 83 percent of median but within the normal range.

In Alberta and British Columbia, streamflow generally decreased seasonally and was in the normal range except in west-central British Columbia, where mean flow in Skeena River at Usk decreased sharply and remained in the below-normal range for the 3d consecutive month.

In Idaho, the seasonal decrease in streamflow was less than normal owing to increased snowmelt runoff that was the result of above-normal temperatures during the month. As a result, monthly mean flows in Snake River near Heise, Salmon River at White Bird, and Clearwater River at Spalding were all above the normal range. Flow in the Boise River was also in the above-normal range. Elsewhere in the State, monthly mean flows were generally above median but within the normal range. Storage at monthend in most reservoirs was above average.

In Montana, monthly mean flows were in the normal range in the northern third of the State, above the normal range elsewhere, and substantially greater than the record or near-record low flows that occurred a year ago. For example, in the western part of the State, the monthly mean discharge of 12,360 cfs at Clark Fork at St. Regis (drainage area, 10,709 square miles) was nearly 5 times the July 1977 discharge and well above the normal range.

In north-central Wyoming, where the monthly mean discharge during June was highest of record at Tongue River near Dayton, flow decreased seasonally but remained in the above-normal range for the 2d consecutive month. (See graph.) In the south-central part of the



Monthly mean discharge of Tongue River near Dayton, Wyo. (Drainage area, 204 sq mi; 528 sq km)

State, monthly mean flow in North Platte River above Seminoe Reservoir, near Sinclair, also decreased seasonally, was 271 percent of median, and remained in the above-normal range.

In Colorado and west of the Continental Divide, monthly mean discharges of Roaring Fork River at Glenwood Springs and of Yampa River at Steamboat Springs, decreased seasonally but remained in the above-normal range for the 2d consecutive month. In contrast, east of the Divide, monthly mean flow in Bear Creek at Morrison continued to decrease, remained in the below-normal range, and was only 28 percent of median. In the southern part of the State, mean flows decreased but remained in the normal range.

In southwestern New Mexico, mean flow in Gila River decreased, contrary to the normal seasonal pattern of increasing flows, and was below the normal range. In the southeastern part of the State, streamflow in Delaware River near Red Bluff also decreased and was below the normal range, in sharp contrast to the above-normal flows in June. In the northern part of the State, mean flows decreased seasonally and were in the normal range. Storage decreased in all major reservoirs in the State.

In southern Arizona, the monthly mean flow of 10.8 cfs in San Pedro River at Charleston (drainage area,

1,219 square miles) was only 11 percent of median, below the normal range for the first time since March 1977, and lowest for July in 67 years of record. In the southwestern part of the State, monthly mean discharge in Gila River at head of Safford Valley, near Solomon, increased seasonally but was below the normal range. In northeastern Arizona, flow at the index station, Little Colorado River near Cameron, ceased on May 23, 1978 and had not resumed at the end of July. In the central part of the State, mean flow in Verde River below Tangle Creek, above Horseshoe Dam decreased, contrary to the normal seasonal pattern of increasing flows, was 75 percent of median, and below the normal range.

In northern Nevada, monthly mean flow of Humboldt River at Palisade decreased seasonally, was 77 percent of median, but within the normal range. Streamflow in the remainder of the State was reported to be near or above average as a result of snowmelt runoff.

In northern Utah, mean flow in Big Cottonwood Creek near Salt Lake City decreased seasonally to 126 percent of median but remained in the above-normal range for the 2d consecutive month. Similarly, in the northwestern part of the State, monthly mean discharge in Green River at Green River decreased seasonally and remained in the above-normal range. Elsewhere in the State, streamflow decreased seasonally at the index stations, was generally above median flows, but within the normal range.

Contents of the Colorado River Storage Project increased 633,630 acre-feet during the month.

Ground-water levels in Washington declined but were above average in the Spokane Valley in the eastern part of the State, and declined reaching a new low for July in the western well near Sumas. In Idaho, the level in the well penetrating the sand and gravel aquifer in the Boise Valley continued its seasonal rise and was slightly above average. Levels in key wells in the Snake River Plain aquifer declined and a new record low was reached, for the second consecutive month, near Atomic City in 29 years of record; new July lows occurred in wells near Eden and Gooding. The level in the key well in the alluvial aquifer underlying the Rathdrum Prairie, northern Idaho, continued to rise slightly but was still below average. In southern California levels in selected observation wells in the coastal plain of Orange County and in the San Gabriel River basin of Los Angeles County declined and were below average. In Santa Barbara County, the level in the key well in the Santa Maria Valley continued below average. However, in the upper Cuyama Valley and Santa Ynez Valley the levels in key wells declined but continued above average; the level in the well in upper Cuyama Valley, despite its decline of more than 6 feet during July, was once again at a new monthend high level–in 28 years of record. In Nevada, the levels in Paradise Valley and Steptoe Valley wells declined but continued above average; the level in the Truckee Meadows well declined and continued below average. In Utah, levels generally declined except in the Blanding and Flowell areas, where levels rose during July; levels continued below average statewide. Levels in three index wells in Arizona declined, with two new July lows, including one recorded in the alluvial aquifer well in the Elfrida area, with 27 years of record. Levels rose in two other index wells, with a new high for July in one. In New Mexico, levels in the key wells declined seasonally and were below average. Despite only a slight decline in level, a new low for July was reached, in 40 years of record, in the Dayton well in the southern part of the Roswell basin.

ALASKA

Streamflow was variable throughout the State but remained below the normal range in most of interior Alaska, as a result of the less-than-normal snowpack and minimal precipitation in May and early June and the cloud cover that inhibited melting of snow and glacier ice at high altitudes during July. For example, the monthly mean discharge of 47,900 cfs, and the daily mean of 33,900 cfs on the 4th at Tanana River at Nenana (drainage area, 25,600 square miles) were the lowest for July in 17 years of record. This is the 2d consecutive month of record-low flows at this gaging station. Also in central Alaska, monthly mean flow of Chena River at Fairbanks remained below the normal range for the 3d consecutive month. Cumulative runoff at that station for the first 10 months of the 1978 water year was only 2/3 of median. In areas near the coast, monthly mean flows decreased in some basins and increased in others, but remained within the normal range.

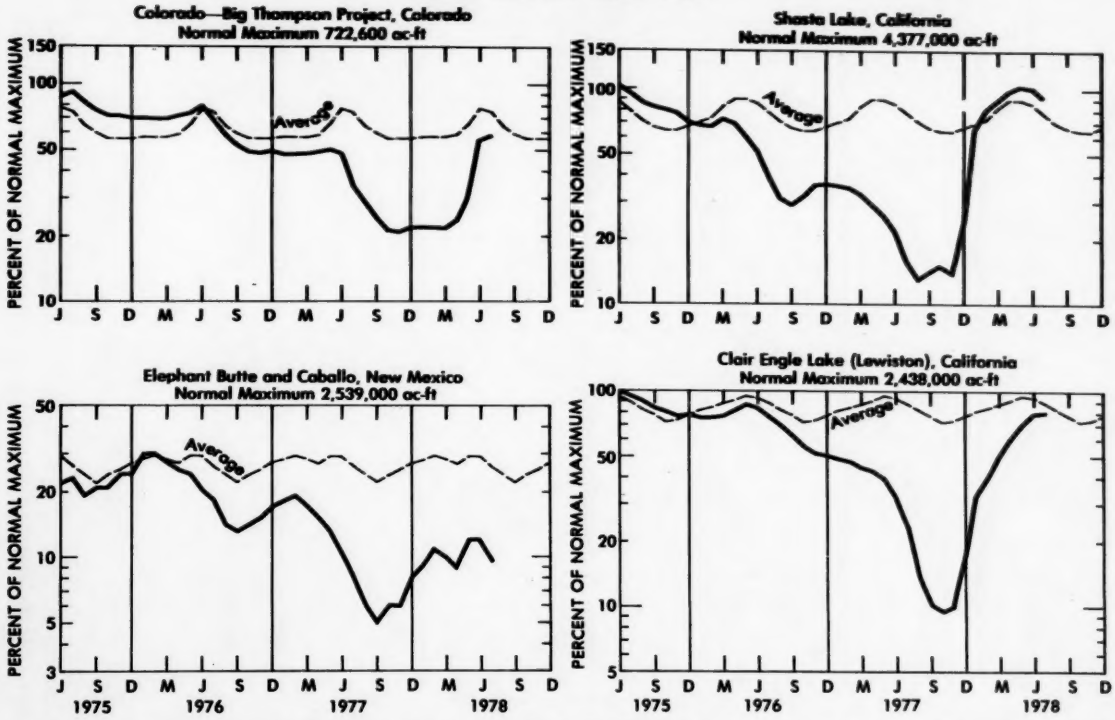
Ground-water levels in the Anchorage area that are representative of the confined aquifer, rose substantially, generally 1.5 to 3 feet. Levels rose as much as 16 feet at pumping centers. The general rise resulted from wet weather and the normal summer shift to surface-water sources. Levels were stable in the shallow water table observation wells.

HAWAII

Streamflow increased at index stations on the islands of Hawaii, Maui, and Oahu, but decreased in East Branch of North Fork Wailua River near Lihue, on the island of Kauai, where mean flow in June was highest of record for the month. Monthly mean flows remained in the above-normal range at index stations on Hawaii, Maui, and Kauai, and were in the normal range on the island of Oahu.

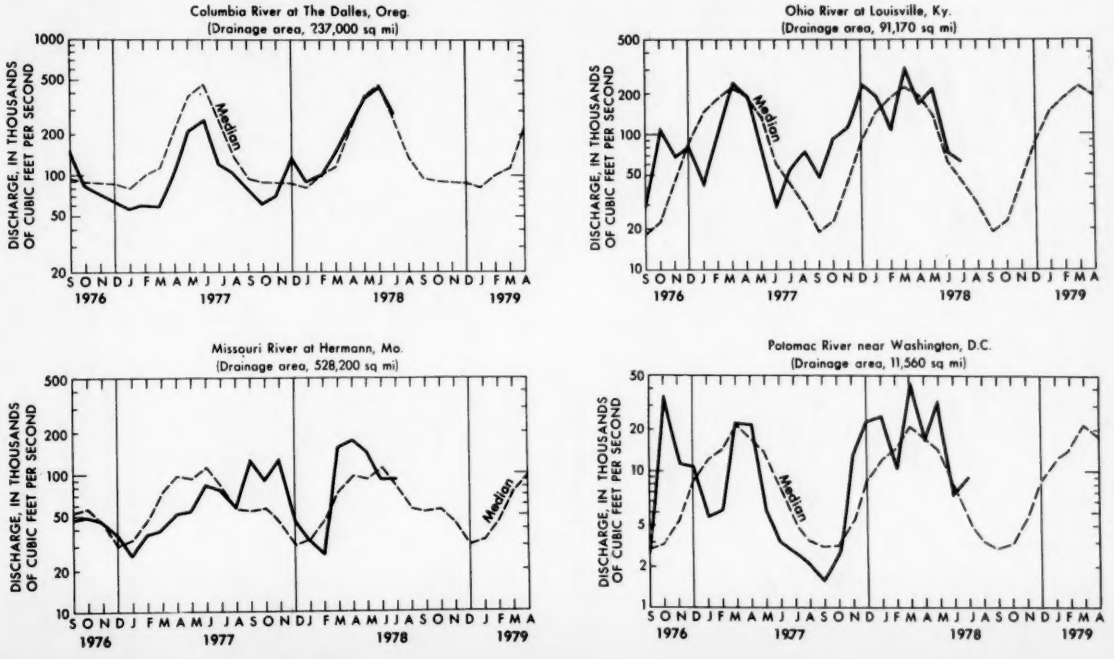
On Guam, Mariana Islands, monthly mean discharge of Ylig River near Yona also increased but remained in the normal range. Mean flows at this site have been below the normal range in 4 of the last 7 months.

USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS, JUNE 1975 TO JULY 1978



Near or above-average contents characterized most reservoirs in the West during July. However, much below-average contents prevailed in the Elephant Butte and Caballo system in New Mexico. (See graph above.)

HYDROGRAPHS OF FOUR LARGE RIVERS



DISSOLVED SOLIDS AND WATER TEMPERATURES FOR JULY AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	July data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
	NORTHEAST										
01463500	Delaware River at	1978	4,949	103	145	1,614	1,216	2,792	24.5	19.5	28.5
	Trenton, N.J.	1945–77	7,378	57	143	.....	465	16,700	....	18.5	33.5
	(Morrisville, Pa.)	(Extreme yr)		(1947)	(1965)		(1965)	(1969)			
			[c]5,066								
04264331	St. Lawrence River at	1978	290,000	167	168	131,000	126,000	137,000	20.0	17.0	22.0
	Cornwall, Ontario, near	1976–77	299,500	166	167	134,000	109,000	158,000	19.5	18.0	21.5
	Massena, N.Y.	(Extreme yr)		(1976, 1977)	(1976, 1977)		(1977)	(1976)			
	median streamflow at Ogdensburg, N.Y.		[c]256,600								
	SOUTHEAST										
07289000	Mississippi River at	1978	484,200	270	303	369,000	342,000	388,000	33.0	31.0	34.5
	Vicksburg, Miss.	1976–77	457,000	211	295	272,000	163,000	383,000	29.0	23.5	31.5
		(Extreme yr)		(1977)	(1977)		(1977)	(1976)			
			[c]456,600								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam	1978	152,600	195	265	.....	45,400	158,000	....	28.0	30.5
	53, near Grand Chain, Ill.	1955–77	156,000	124	276	.....	25,000	237,000	....	16.5	31.0
	(25 miles west of Paducah,	(Extreme yr)		(1965, 1967)	(1968)		(1966)	(1958)			
	Ky.; streamflow station		[c]130,200								
	at Metropolis, Ill.)										
	MIDCONTINENT										
06934500	Missouri River at Hermann,	1978	91,300	259	380	82,800	64,600	131,000	28.0	25.0	30.0
	Mo. (60 miles west of St.	1976–77	68,050	239	421	59,400	44,700	110,000	28.0	24.5	30.0
	Louis, Mo.)	(Extreme yr)		(1977)	(1977)		(1977)	(1977)			
			[c]79,360								
	WEST										
14128910	Columbia River at	1978	191,500	69	73	38,300	28,600	47,400	18.0	17.0	19.5
	Warrendale, Oreg.	1976–77	163,600	60	93	32,200	12,500	54,700	18.5	16.0	20.0
	(streamflow station	(Extreme yr)		(1976)	(1977)		(1977)	(1976)			
	at The Dalles, Oreg.)		[c]275,900								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JULY 1978

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of June 1978	End of July 1978	End of July 1977	Average for end of July	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	73	63	79	59	226,300 (a)
QUEBEC					
Allard (P)	89	77	89	75	280,600 ac-ft
Gouin (P)	76	74	96	66	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	93	86	85	79	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	92	90	87	89	3,330 mcf
Lake Francis (FPR)	91	83	81	87	4,326 mcf
Lake Winnipesaukee (PR)	101	91	93	88	7,200 mcf
VERMONT					
Harriman (P)	83	79	78	78	5,060 mcf
Somerset (P)	80	74	80	83	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	89	82	80	83	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	89	81	83	82	34,270 mcf
Indian Lake (FMP)	98	96	90	90	4,500 mcf
New York City reservoir system (MW)	98	91	86	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	96	86	76	81	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	49	45	47	44	51,400 mcf
Pymatuning (FMR)	100	97	100	93	8,191 mcf
Raystown Lake (FR)	68	68	68	56	33,190 mcf
Lake Wallenpaupack (PR)	82	72	71	73	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	98	97	86	91	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	92	92	86	89	12,580 mcf
Narrows (Badin Lake) (P)	98	97	96	97	5,617 mcf
High Rock Lake (P)	84	92	65	76	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	90	87	82	76	70,300 mcf
Lakes Marion and Moultrie (P)	85	81	71	70	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	75	71	63	70	75,360 mcf
GEORGIA					
Burton (PR)	99	93	90	91	104,000 ac-ft
Sinclair (MPR)	86	89	82	90	214,000 ac-ft
Lake Sidney Lanier (FMPR)	63	60	59	62	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	98	95	90	90	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	66	59	48	64	1,156,000 cfsd
Douglas Lake (FPR)	70	54	45	60	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	76	72	77	76	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	69	61	54	62	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	70	65	72	78	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	96	97	77	84	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	87	90	47	73	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	37	39	24	38	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	96	96	80	.....	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	100	100	59	84	127,600 ac-ft
Bell Fourche (I)	99	80	23	55	185,200 ac-ft
Lake Francis Case (FIP)	82	81	72	82	4,834,000 ac-ft
Lake Oahe (FIP)	97	97	79	.....	22,530,000 ac-ft

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of June 1978	End of July 1978	End of July 1977	Average for end of July	Normal maximum
	Percent of normal maximum				
MIDCONTINENT REGION—Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	102	103	101	100	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	77	91	95	95	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	74	64	67	74	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	103	93	94	89	2,378,000 ac-ft
Keystone (FPR)	108	93	102	95	661,000 ac-ft
Tenkiller Ferry (FPR)	113	102	95	95	628,200 ac-ft
Lake Altus (FIMR)	99	73	81	61	134,500 ac-ft
Lake O'The Cherokees (FPR)	99	94	94	91	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	100	97	98	97	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	61	53	91	50	386,400 ac-ft
Canyon (FMR)	95	93	92	68	385,600 ac-ft
International Amistad (FIMPW)	86	81	100	67	3,497,000 ac-ft
International Falcon (FIMPW)	69	67	96	66	2,667,000 ac-ft
Livingston (IMW)	95	87	100	79	1,788,000 ac-ft
Possum Kingdom (IMPRW)	86	82	94	104	569,400 ac-ft
Red Bluff (PI)	10	10	13	24	307,000 ac-ft
Toledo Bend (P)	93	88	96	87	4,472,000 ac-ft
Twin Buttes (FIM)	74	64	89	21	177,800 ac-ft
Lake Kemp (IMW)	59	46	84	91	268,000 ac-ft
Lake Meredith (FMW)	40	37	36	40	821,300 ac-ft
Lake Travis (FIMPRW)	57	54	92	77	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	99	100	66	95	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	87	97	94	96	5,232,000 ac-ft
Lake Chelan (PR)	96	100	87	98	676,100 ac-ft
Lake Cushman	102	103	77	99	359,500 ac-ft
Lake Merwin (P)	102	106	106	105	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	82	85	32	76	1,235,000 ac-ft
Coeur d'Alene Lake (P)	100	99	98	81	238,500 ac-ft
Pend Oreille Lake (FP)	99	99	100	95	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	90	84	31	70	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	96	101	64	89	802,000 ac-ft
Buffalo Bill (IP)	102	103	61	101	421,300 ac-ft
Keyhole (F)	86	86	68	47	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	69	65	52	56	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	0	0	0	19	364,400 ac-ft
Taylor Park (IR)	66	76	57	91	106,200 ac-ft
Colorado–Big Thompson project (I)	56	59	34	72	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	72	74	68	.....	31,280,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	72	72	60	66	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	94	87	24	77	1,000,000 ac-ft
Hetch Hetchy (MP)	88	101	41	77	360,400 ac-ft
Isabella (FIR)	87	86	10	37	551,800 ac-ft
Pine Flat (FI)	86	89	15	51	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	79	81	23	84	2,438,000 ac-ft
Lake Almanor (P)	96	99	64	60	1,036,000 ac-ft
Lake Berryessa (FIMW)	79	76	52	82	1,600,000 ac-ft
Millerton Lake (FI)	77	95	42	64	503,200 ac-ft
Shasta Lake (FIPR)	99	91	16	78	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	34	35	19	71	744,600 ac-ft
NEVADA					
Rye Patch (I)	47	47	42	84	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	80	79	75	72	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	18	13	0	12	1,073,000 ac-ft
Salt and Verde River system (IMPR)	87	81	30	39	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	33	30	23	77	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	12	10	8	26	2,539,000 ac-ft

[a]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

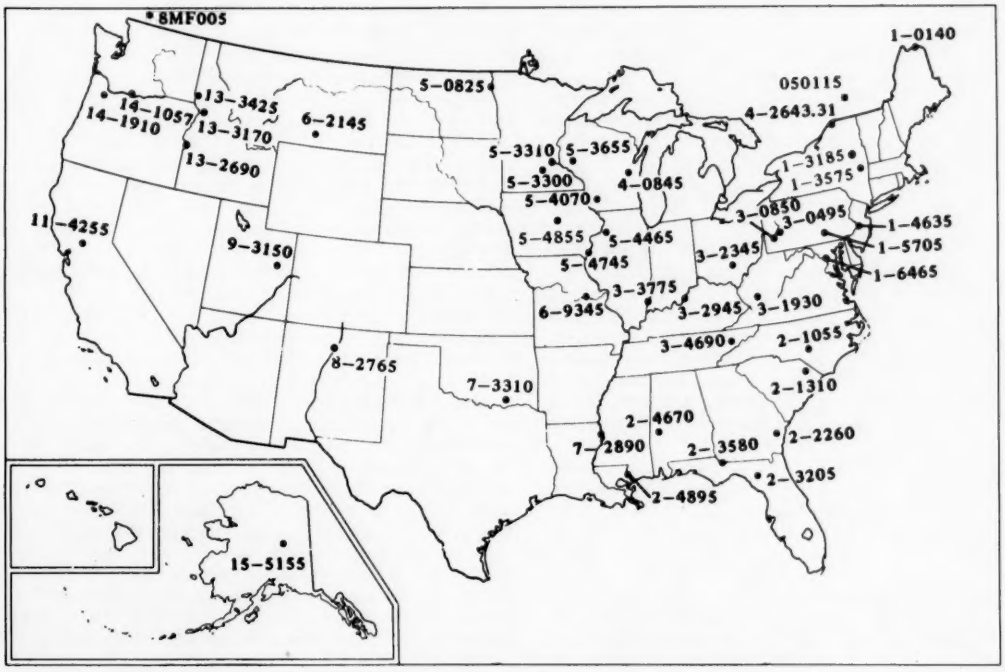
FLOW OF LARGE RIVERS DURING JULY 1978

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	July 1978					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine	5,690	9,397	3,545	76	-63	2,250	1,450	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	575	51	-72	440	280	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	1,306	71	-62	.....	.....	.....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	5,018	99	-46	3,690	2,380	26
1–5705	Susquehanna River at Harrisburg, Pa	24,100	33,670	12,770	110	-49	9,970	6,440	25
1–6465	Potomac River near Washington, D.C	11,560	[1] 10,640	8,990	204	+34	3,100	2,000	31
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C	4,810	4,847	3,330	152	-25	1,500	970	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	6,530	111	-15	7,360	4,760	28
2–2260	Altamaha River at Doctortown, Ga	13,600	13,380	4,080	57	-40	3,760	2,430	28
2–3205	Suwannee River at Branford, Fla	7,740	6,775	4,630	92	-29	4,640	3,000	31
2–3580	Apalachicola River at Chattahoochee, Fla	17,200	21,690	11,700	75	-38	12,000	7,760	31
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala	15,400	21,700	4,325	73	-76	2,730	1,760	26
2–4895	Pearl River near Bogalusa, La	6,630	8,533	2,871	101	-51	3,680	2,380	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 18,700	6,628	110	-37	7,650	4,940	25
3–0850	Monongahela River at Braddock, Pa	7,337	[1] 11,950	16,273	394	+128	5,900	3,800	25
3–1930	Kanawha River at Kanawha Falls, W.Va	8,367	12,370	5,653	116	-14	3,160	2,040	25
3–2345	Scioto River at Higby, Ohio	5,131	4,337	1,710	108	-48	1,420	920	26
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	63,260	146	-14	28,000	18,000	31
3–3775	Wabash River at Mount Carmel, Ill	28,600	26,310	23,540	161	+18	15,000	9,700	31
3–4690	French Broad River below Douglas Dam, Tenn	4,543	[1] 6,528	2,759	68	-49	.....	.....	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis[2]	6,150	4,142	5,355	184	+52	.....	.....	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y[3]	299,000	239,100	290,400	113	-6	282,000	182,000	31
050115	St. Maurice River at Grand Mere, Quebec	16,300	24,900	11,300	52	-56	20,000	12,900	31
5–0825	Red River of the North at Grand Forks, N. Dak	30,100	2,439	3,104	106	-3	2,450	1,580	31
5–3300	Minnesota River near Jordan, Minn	16,200	3,306	3,960	103	-47	3,780	2,440	24
5–3310	Mississippi River at St. Paul, Minn	36,800	[1] 10,230	21,810	183	+7	18,500	12,000	24
5–3655	Chippewa River at Chippewa Falls, Wis	5,600	5,062	7,964	213	+31	.....	.....	.....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	18,818	281	+67	.....	.....	.....
5–4465	Rock River near Joslin, Ill	9,520	5,288	16,000	460	+100	9,100	5,880	31
5–4745	Mississippi River at Keokuk, Iowa	119,000	61,210	134,390	203	+54	116,500	75,300	31
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa	9,879	3,796	7,333	203	+51	4,450	2,880	31
6–2145	Yellowstone River at Billings, Mont	11,796	6,754	24,650	164	-20	16,700	10,800	31
6–9345	Missouri River at Hermann, Mo	528,200	78,480	93,010	117	+4	148,000	95,700	26
7–2890	Mississippi River at Vicksburg, Miss[4]	1,144,500	552,700	484,200	106	-25	478,000	309,000	31
7–3310	Washita River near Durwood, Okla	7,202	1,379	390	58	-92	180	120	31
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex	9,730	732	593	179	-29	490	320	31
9–3150	Green River at Green River, Utah	40,600	6,369	10,583	165	-61	5,500	3,600	31
11–4255	Sacramento River at Verona, Calif	21,257	18,370	12,860	162	-30	14,800	9,570	27
13–2690	Snake River at Weiser, Idaho	69,200	17,670	11,510	106	-37	8,440	5,450	28
13–3170	Salmon River at White Bird, Idaho	13,550	11,060	22,300	171	-52	11,200	7,240	27
13–3425	Clearwater River at Spalding, Idaho	9,570	15,320	13,620	142	-62	7,510	4,850	26
14–1057	Columbia River at The Dalles, Oreg[5]	237,000	194,000	286,500	107	-36	.....	.....	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	5,617	88	-39	5,620	3,630	27–31
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	47,922	82	+70	50,000	32,000	31
8MF005	Fraser River at Hope, British Columbia	83,800	95,300	158,000	86	-21	130,000	84,000	27

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 16.

WATER RESOURCES REVIEW

July 1978

Based on reports from the Canadian and U.S. field offices; completed August 14, 1978

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for July based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for July 1978 is compared with flow for July in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for December is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the July flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of July. Water level in each key observation well is compared with average level for the end of July determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of June to the end of July.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES–TENNESSEE REGION

The abstract (abridged) and map below are from the report, *Summary appraisals of the Nation's ground-water resources–Tennessee Region,* by Ann Zurawski: U.S. Geological Survey Professional Paper 813-L, 35 pages, 1978. This report may be purchased for $1.60 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

Ground water is an abundant and little-used resource in the Tennessee Region, a 41,000 square mile area dominated by the Tennessee River system and including parts of Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. One-fifth to one-fourth of the precipitation that falls on the region enters the ground-water reservoirs. During the year about the same amount of water leaves the ground-water system, sustaining the dry-weather flow of streams. Recharge for the region is about 22,000 million gallons per day or 0.5 million gallons per day per square mile.

The major types of aquifers in the region are unconsolidated material, carbonate rocks, and fractured noncarbonate rocks (fig. 1). One or more of these aquifer types occurs in each of the six physiographic subdivisions of the region. The productivity depends on hydraulic properties and on the distribution of these properties. The unconsolidated sand aquifers are the most homogeneous in composition and most predictable in occurrence. They commonly yield 200 to 600 gallons per minute per well.

The most difficult aquifers to predict in regard to depth and yield are the carbonate rocks. In these aquifers it is possible to drill dry holes near wells capable of producing several thousand gallons per minute. However, with adequate reconnaissance and test drilling, yields of up to 300 gallons per minute per well can be expected. Potential yields from the fractured noncarbonate aquifers are lower than in the carbonate rocks.

The chemical and physical properties of ground water in the region are usually within the limits recommended by the Environmental Protection Agency for drinking water. Saline water is not known to occur in significant quantities.

In 1970, 173 million gallons per day of ground water were used in the region. This was less than 8 percent of the total quantity of water used in the region. Ground water is used chiefly in rural areas and small towns. A lesser amount is used by industries and commercial establishments located beyond the limits of municipal water-supply systems.

Hydrologic studies and adequate test drilling would greatly increase the chances of locating large amounts of ground water. Hydrologic studies that include test drilling have been conducted in all parts of the region except the Cumberland Plateau.

Some of the basic data necessary for hydrologic studies are available throughout the region. However, detailed information on ground-water levels, ground-water quality, and aquifer characteristics are not equally available throughout the region. This type of information cannot be obtained quickly when it is needed; it must be the product of a continuing program of studies designed to evaluate the Tennessee Region's ground-water resource.

Because of the interdependence of ground water and surface water, water management efforts can be fully effective only if they involve the whole water resource. In the Tennessee Region, surface water is highly controlled, but there is at present no regionwide water-resources management plan that includes ground water.

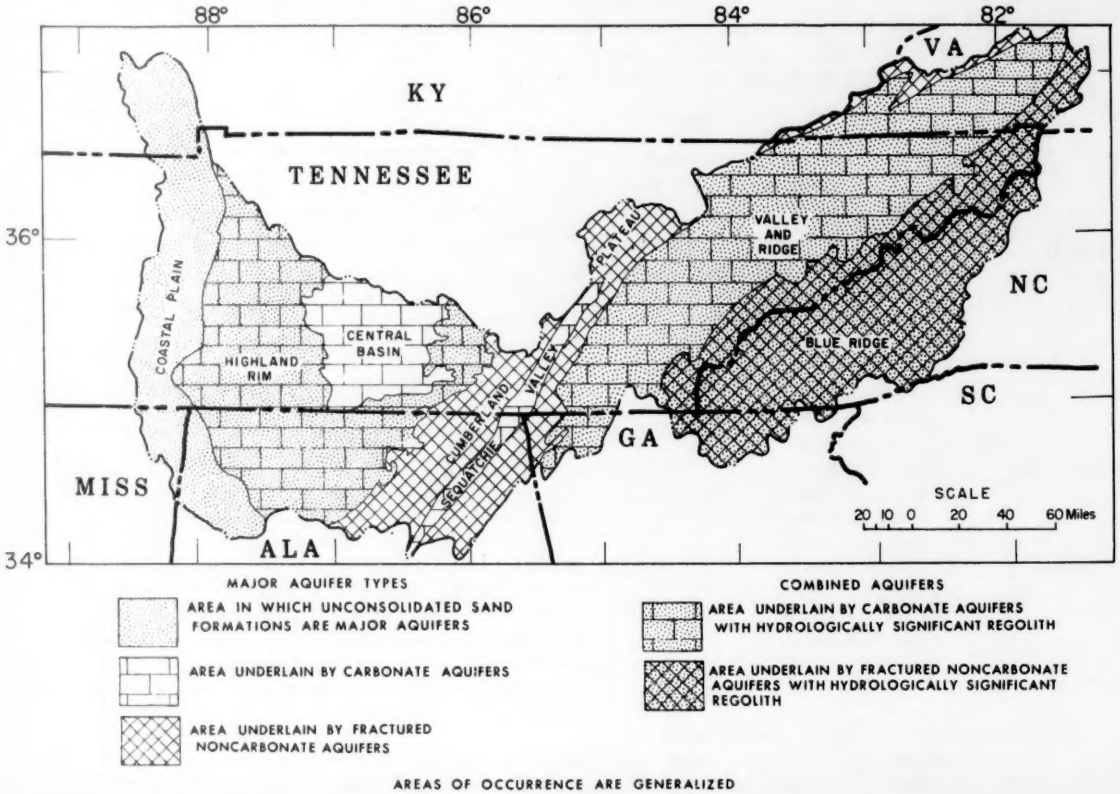

Figure 1.—Distribution of major aquifer types in the Tennessee Region.